

What is claimed:

1. An aromatic fluorophosphorus compound suitable for use as an antioxidant said compound being selected from fluorophosphorus compounds having the structure:



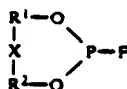
Formula V

wherein R is [an] a substituted aryl group wherein the substituents are [tert-alkyl] groups selected from the group consisting of sec-alkyl, tert-alkyl, aryl, aralkyl, cycloalkyl, hydroxy, alkoxy, aryloxy, alkoxycarbonyl, alkoxycarbonylalkyl and acyloxy [:] 1



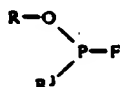
Formula VI

wherein R' is a substituted aryl group wherein the substituents are selected from sec-alkyl, tert-alkyl, aryl, aralkyl, cycloalkyl, hydroxy, alkoxy, aryloxy, halo, acyloxy, alkoxycarbonyl, and [alkoxy carbonylalkyl:] alkoxycarbonylalkyl [:] 1



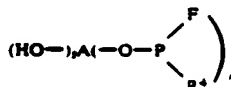
Formula II

wherein R<sup>1</sup> and R<sup>2</sup> are substituted or unsubstituted aryl groups wherein the substituent are selected from alkyl, aryl, aralkyl, cycloalkyl, hydroxy, alkoxy, aryloxy, and halo; and X is selected from the group consisting of a single bond connecting R<sup>1</sup> and R<sup>2</sup> and divalent bridging groups selected from divalent aliphatic hydrocarbon groups containing 1-12 carbon atoms, -O- and -S<sub>q</sub>- wherein q is an integer from 1 to 3:



Formula III

wherein R is a substituted or unsubstituted aryl group wherein the substituents are selected from alkyl, aryl, aralkyl, cycloalkyl, hydroxy, alkoxy, aryloxy, halo, alkoxycarbonyl, alkoxycarbonylalkyl and acyloxy, and R<sup>3</sup> is selected from the group consisting of alkyl, cycloalkyl, aralkyl, aryl, substituted aryl, alkoxy, cycloalkoxy and aralkoxy; and



Formula IV

wherein A is a mono- or poly-nuclear aromatic group, R<sup>4</sup> is independently selected from fluorine, aryloxy, alkylaryloxy, alkoxy and polyalkoxy, r is an integer from 1 to 4, s is an integer from 0 to 3 and (r+s) equals the valence of A.

and A has a structure selected from:

wherein  $R^5$  and  $R^6$  are hydrogen or alkyl having 1-12 carbon atoms with at least one of  $R^5$  or  $R^6$  being an alkyl group,  $y$  is an integer from 2 to 3,  $x$  is an integer from 1 to 3,  $t$  is an integer from 2 to 3,  $u$  is an integer from 0 to 4,  $(t + u)$  equals 2 to 6,  $w$  is an integer from 1 to 4,  $R^7$  is a hydrogen or an alkyl having 1 to 6 carbon atoms,  $R^8$  is an aliphatic hydrocarbon radical having 1-30 carbon atoms and having valence  $w$ ,  $v$  is an integer from 0 to 4,  $R^9$  is an aliphatic hydrocarbon radical having 1 to 6 carbon atoms and having valence  $v$ .

2. A compound of claim 1 namely bis(2,6-di-tert-butylphenyl) fluorophosphite.

3. A compound of claim 1 namely: bis(2,4-di-tert-butylphenyl) fluorophosphite.

4. A compound of claim 1 namely bis(4-octadecyloxy-carbonylethyl-2,6-di-tert-butylphenyl) fluorophosphite.

5. A compound of claim 1 namely: 2,2'-thylidenebis(4,6-di-tert-butylphenyl) fluorophosphite.

6. A compound of claim 1 namely: [bis(difluorophosphite ester) of 4,4'-methylenebis(2,6-di-tert-butylphenol).] 4,4'-Methylenebis(2,6-di-tert-butylphenyl) bis(difluorophosphite).

7. A compound of claim 1 namely: 2,2'-bis(4,6-di-tert-butylphenyl) fluorophosphite.

8. Organic material normally susceptible to gradual oxidative degradation when in contact with oxygen, said organic material containing having incorporated therein by mixing or spraying an antioxidant amount of an aromatic fluorophosphorus compound, said compound being characterized by having at least one benzene group bonded through oxygen to a trivalent phosphorus.

its alkoxy moiety and 4 1-3 carbon atoms in its alkyl moiety.

15. A composition of claim 14 wherein said fluorophosphite compound is bis(2,6-di-tert-butylphenyl) fluorophosphite.

16. A composition of claim 14 wherein said fluorophosphite is bis(2,4-di-tert-butylphenyl) fluorophosphite.

17. A composition of claim 14 wherein said fluorophosphite compound is bis(4-octadecyloxycarbonyl-ethyl-2,6-di-tert-butylphenyl) fluorophosphite.

18. A composition of claim 12 wherein n is 1.

19. A composition of claim 9 wherein said fluorophosphite compound has Formula II wherein said substituents are selected from alkyl having 1-20 carbon atoms, aryl having 6-12 carbon atoms, aralkyl having 7-12 carbon atoms, cycloalkyl having 5-8 carbon atoms, hydroxy, alkoxy having 1-12 carbon atoms, aryloxy having 6-12 carbon atoms and halo, and X is selected from the group consisting of a single bond connecting R<sup>1</sup> and R<sup>2</sup> and divalent bridging groups selected from divalent aliphatic hydrocarbon groups containing 1-12 carbon atoms, —O— and —S<sub>q</sub>— wherein q is an integer from 1-3.

20. A composition of claim 19 wherein said substituent groups are alkyls containing 1-20 carbon atoms.

21. A composition of claim 20 wherein said fluorophosphorus compound is 2,2'-ethylidenebis(4,6-di-tert-butylphenyl) fluorophosphite.

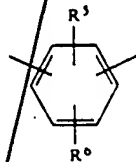
22. A composition of claim 20 wherein said fluorophosphorus compound is 2,2'-methylenebis(4-methyl-6-tert-butylphenyl) fluorophosphite.

23. A composition of claim 20 wherein said fluorophosphite compound is 2,2'-bis(4,6-di-tert-butylphenyl) fluorophosphite.

24. A composition of claim 9 wherein said fluorophosphorus compound has Formula III wherein said substituents are selected from alkyls having 1-20 carbon atoms, aryls having 6-12 carbon atoms, aralkyls having 7-12 carbon atoms, cycloalkyls having 5-8 carbon atoms, hydroxy, alkoxy having 1-12 carbon atoms, aryloxy having 6-12 carbon atoms, halo, alkoxy-carbonylalkyl having 1-20 carbon atoms in its alkoxy moiety and 1-3 carbon atoms in its alkyl moiety, alkoxy-carbonyl having 1-20 carbon atoms in its alkoxy moiety and acyloxy having 1-4 carbon atoms, and R<sup>3</sup> is selected from alkyl having 1-20 carbon atoms, cycloalkyl having 5-8 carbon atoms and aralkyls having 7-12 carbon atoms which are bonded through [oxygen] oxygen to phosphorus and aryls having 6-12 carbon atoms, alkyl having 1-20 carbon atoms, cycloalkyls having 5-8 carbon atoms and aralkyls having 7-12 carbon atoms which are bonded directly to said phosphorus.

25. A composition of claim 9 wherein said fluorophosphorus compound has Formula IV.

26. A composition of claim 25 wherein A has a structure selected from:



Structure IV (i)

from 1 to 3, t is an integer from 2 to 3, u is an integer from 0 to 4, (t+u) equals 2 to 6, w is an integer from 1 to 4, R<sup>7</sup> is hydrogen or an alkyl having 1 to 6 carbon atoms, R<sup>8</sup> is an aliphatic hydrocarbon radical having 1-30 carbon atoms and having valence w, v is an integer from 0 to 4, R<sup>9</sup> is an aliphatic hydrocarbon radical having 1 to 6 carbon atoms and having valence y.

27. A composition of claim 26 wherein said fluorophosphorus compound is 2,5-di-tert-butyl-1,4-phenylene bis (difluorophosphite).

28. A composition of claim 26 wherein said fluorophosphorus compound is 4,4'-methylenebis(2,6-di-tert-butylphenyl) bis(difluorophosphite).

29. A composition of claim 26 wherein said fluorophosphite compound is the tris(difluorophosphite ester) of 1,3,5-tris(3,5-di-tert-butyl-4-hydroxybenzyl)-2,4,6-trimethyl benzene.

30. A composition of claim 26 wherein said fluorophosphorus compound is the tetrakis(difluorophosphite ester) of tetrakis(methylene 3-(3,5-di-tert-butyl-4-hydroxyphenyl) propionate)methane.

31. A composition of claim 26 wherein said fluorophosphite compound is difluorophosphite ester of octadecyl 3-(3,5-di-tert-butyl-4-hydroxyphenyl)propionate.

32. An organic composition of claim 8 further characterized by containing about 0.005-5 wt. percent of a phenolic antioxidant.

33. An organic composition of claim 9 further characterized by containing about 0.005-5 wt. percent of a phenolic antioxidant.

34. An organic composition of claim 12 further characterized by containing about 0.005-5 wt. percent of a phenolic antioxidant.

35. An organic composition of claim 15 further characterized by containing about 0.005-5 wt. percent of a phenolic antioxidant.

36. An organic composition of claim 16 further characterized by containing about 0.005-5 wt. percent of a phenolic antioxidant.

37. An organic composition of claim 17 further characterized by containing about 0.005-5 wt. percent of a phenolic antioxidant.

38. An organic composition of claim 19 further characterized by containing about 0.005-5 wt. percent of a phenolic antioxidant.

39. An organic composition of claim 21 further characterized by containing about 0.005-5 wt. percent of a phenolic antioxidant.

40. An organic composition of claim 39 wherein said phenolic antioxidant is 1,3,5-tris(3,5-di-tert-butyl-4-hydroxybenzyl)-2,4,6-trimethylbenzene.

41. An organic composition of claim 39 further characterized by containing about 0.005-5 wt. percent of a phenolic antioxidant.

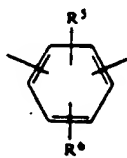
42. An organic composition of claim 25 further characterized by containing about 0.005-5 wt. percent of a phenolic antioxidant.

.....

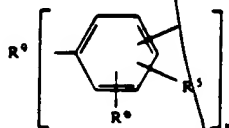
add  
a<sup>3</sup>  
add  
b<sup>7</sup>

Sub  
D<sup>1</sup>

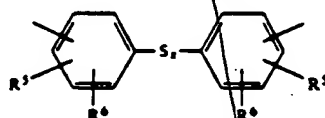
D<sup>6</sup> com +



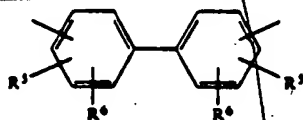
Structure IV (i)



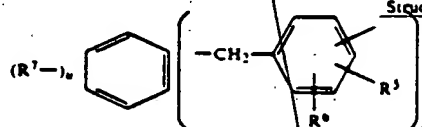
Structure IV (ii)



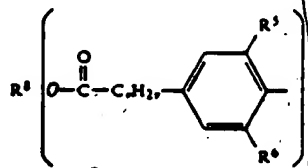
Structure IV (iii)



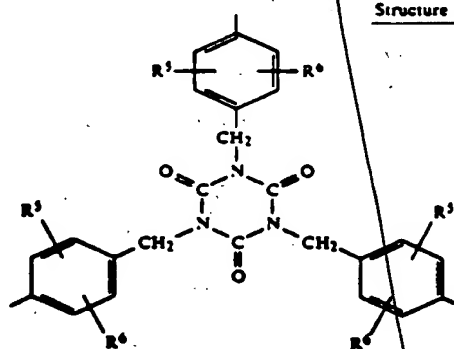
Structure IV (iv)



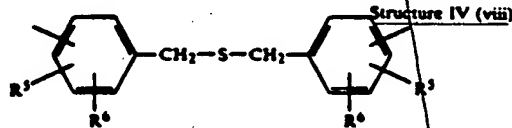
Structure IV (v)



Structure IV (vi)



Structure IV (vii)



Structure IV (viii)

Pub  
A cont 8  
B+D'

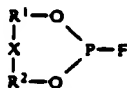
phorus atom and at least one fluorine atom bonded to said phosphorus atom.

9. An organic composition of claim 8 wherein said fluorophosphorus compound is selected from the group consisting of compounds having the structures:



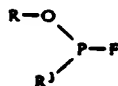
Formula I

wherein R is a substituted or unsubstituted aryl group wherein the substituents are selected from alkyl, aryl, aralkyl, cycloalkyl, hydroxy, alkoxy, aryloxy, halo, alkoxycarbonyl, alkoxycarbonylalkyl and acyloxy and n is 1 or 2,



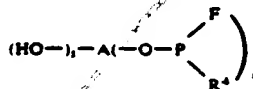
Formula II

wherein R<sup>1</sup> and R<sup>2</sup> are substituted or unsubstituted aryl groups wherein the substituents are selected from alkyl, aryl, aralkyl, cycloalkyl, hydroxy, alkoxy, aryloxy and halo, and X is selected from the group consisting of a single bond connecting R<sup>1</sup> and R<sup>2</sup> and divalent bridging groups selected from divalent aliphatic hydrocarbons containing 1-12 carbon atoms, —O— and —S— wherein q is an integer from 1 to 3;



Formula III

wherein R is as previously defined for Formula I and R<sub>3</sub> is selected from the group consisting of alkyl, cycloalkyl, aralkyl, aryl, substituted aryl, alkoxy, cycloalkoxy, aryloxy and aralkoxy; and



Formula IV

wherein A is a mono or polynuclear aromatic group, R<sup>4</sup> is independently selected from fluorine, aryloxy, alkaryloxy, alkoxy and polyalkoxy and r is an integer from 1 to 4, s is an integer from 0 to 3 and (r+s) equals the valence of A.

10. A composition of claim 8 wherein said organic material is a polymer of an olefinically unsaturated monomer.

11. A composition of claim 9 wherein said organic material is a polymer of an olefinically unsaturated monomer.

12. A composition of claim 11 wherein said compound has Formula I.

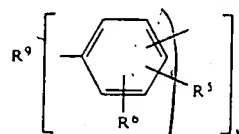
13. A composition of claim 12 wherein n is 2 and said substituents are selected from alkyls having 1-20 carbon atoms, aryls having 6-12 carbon atoms, aralkyls having 7-12 carbon atoms, cycloalkyls having 5-8 carbon atoms, hydroxy, alkoxy having 1-12 carbon atoms, aryloxy having 6-12 carbon atoms, halo, alkoxycarbonylalkyl having 1-20 carbon atoms in its alkoxy moiety and 1-3 carbon atoms in its alkyl moiety, alkoxycarbonyl having 1-20 carbon atoms in its alkoxy moiety and acyloxy having 1-4 carbon atoms.

14. A composition of claim 13 wherein said substituents are selected from alkyl having 1-20 carbon atoms and alkoxy carbonylalkyl having 1-20 carbon atoms in

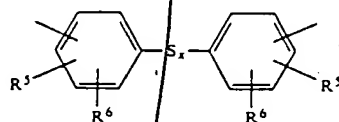
Sub  
B3 D3

Sub  
B3 D3

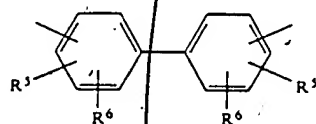
-continued



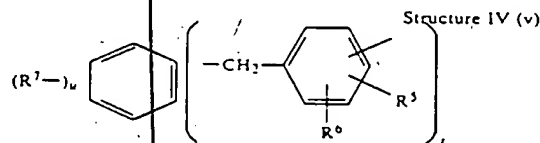
Structure IV (ii)



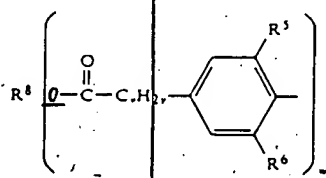
Structure IV (iii)



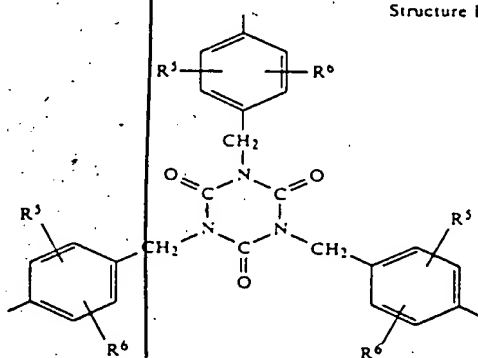
Structure IV (iv)



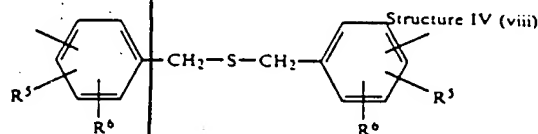
Structure IV (v)



Structure IV (vi)



Structure IV (vii)



Structure IV (viii)

wherein  $R^5$  and  $R^6$  are hydrogen or alkyl having 1-12 carbon atoms,  $y$  is an integer from 2 to 3,  $x$  is an integer